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Abstracts Book

Dynamics of CO2, CH4 and N2O concentrations throughout deep soil profiles in Eucalypt plantations subjected to contrasted rainfall regimes: consequences on soil effluxes

Amandine Germon * [1,2], Christophe Jourdan [2], Lydie Chapuis-Lardy [3], Loic Pagès [4], Frederic Gerard [5], Céline Blitz-Frayret [2], Yann Nouvellon [2], Agnès Robin [2], Ciro Rosolem [1], José Leonardo Gonçalves [6], Iraê Guerrini [1], Jean-Paul Laclau [1,2,6]

[1] São Paulo State University, School of Agricultural Sciences (UNESP) – Botucatu, SP, Brazil
[2] UMR EcoSols (Univ Montpellier, Cirad, Inra, IRD, Montpellier SupAgro) – CIRAD – 34060 Montpellier, France
[3] Institut de recherche pour le développement (IRD) – 18524, Dakar, Senegal
[4] UR PSH (Inra) – INRA – 84914 Avignon, France
[5] UMR EcoSols (Univ Montpellier, Inra, Cirad, IRD, Montpellier SupAgro) – INRA – 34060 Montpellier, France
[6] Escola Superior de Agricultura "Luiz de Queiroz" (ESALQ) – Piracicaba, SP, CEP 13418-900, Brazil

The major factors driving greenhouse gas exchanges in forest soils (substrate supply, temperature, water content) vary with soil depth. Our study aimed to assess the effects of clear-cutting and drought on the temporal variability of CO2, CH4 and N2O fluxes throughout very deep soil profiles in Brazilian eucalypt plantations conducted in coppice. Stands with 37% of throughfall excluded by plastic sheets (-W) and stands without rain exclusion (+W) were compared. Every two weeks for 21 months, CO2, CH4 and N2O surface effluxes were measured using the closed-chamber method and concentrations in the soil were measured at 7 depths down to 15.5 m in -W and +W. At most measurement dates, CO2, CH4 and N2O effluxes at the soil surface were not significantly different between -W and +W. Mean CO2 and N2O concentrations in -W were 20.7% and 7.6% lower than in +W, respectively, across the sampling depths. By contrast, CH4 concentrations in -W were 44.4% higher than in +W throughout the soil profile. Across the two treatments, CO2 concentrations increased from 4446 ± 2188 ppm at 10 cm deep to 15622 ± 3523 ppm at 15.5 m, CH4 concentrations increased from 0.41 ± 0.17 ppm at 10 cm deep to 0.77 ± 0.24 ppm at 15.5 m and N2O concentrations remained roughly constant and were on average 478 ± 55 ppb from the soil surface to 15.5 m deep. A modeling approach (using the Min3P and Root Typ models) showed that the amount of water filling soil porosity accounted for a large share of the difference in gas concentration between +W and –W, and pointed out the consequences of throughfall exclusion on the areas of CO2 production throughout the soil profile. Improving our understanding of the spatiotemporal dynamics of gas concentrations in deep soil layers is important to improve the current biogeochemical models predicting the effect

*Speaker

of drought periods on greenhouse gas effluxes in eucalypt plantations established in deep tropical soils.

Keywords: Brazil, greenhouse gases, deep tropical soil, drought, coppice